EFFECT OF CAFFEINE, STRESS, COLD PRESSOR TEST, AND PHYSICAL ACTIVITY ON BLOOD PRESSURE IN MIDDLE AGED (30 – 50 YEARS) HYPERTENSIVE INDIVIDUALS

THESIS FOR

DOCTOR OF MEDICINE

(INTERNAL MEDICINE)

BUNDELKHAND UNIVERSITY
JHANSI (U.P.)

2004

SANJAY PANT

Dedicated

To

My Patients,

Past & Future

CERTIFICATE

This is to certify that the work entitled **"Effect of Caffeine, stress, cold pressor test (CPT), and physical activity (PA) on BP in middle aged (30 – 50 years) hypertensive individuals"** which is being submitted as a thesis for M.D. (Medicine) Examination 2004 of Bundelkhand University, Jhansi, has been carried out by ***Dr.Sanjay Pant*** in the Department of Medicine, M.L.B. Medical College, Jhansi.

This method described was undertaken by the candidate himself and the observations recorded have been periodically checked up. He has put in the necessary stay in the Department as per University regulations, and has fulfilled the conditions required for the submission of thesis according to University regulations.

Dated: 27/1/04

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Dated: 27/1/04

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CERTIFICATE

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Acknowledgement

Today, I pick my pen to express my heart felt thanks to all those who helped me realize what I consider so dear. I have no dearth of feelings but only an understanding of the futility of my expression. For, I am sure, I can never manage to bring forth my sincere gratitude towards all who have meant so much in the formation of this project. Yet I shall try.

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Dated:26/ i / 04

Sanjay Pant

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Introduction

Introduction

As the population becomes older and more obese, the number of people with hypertension continues to increase. In developing countries worldwide, with the increase in urbanization and adoption of sedentary life style and high fat, high caloric diet, it is estimated that the incidence and prevalence of hypertension is increasing, alarmingly. As a consequence of the increased awareness of the damage caused by hypertension and with the recognition that the progress of hypertension induced cardiovascular diseases, can be slowed down by its treatment, the management of hypertension is now the most common indication for visits to physicians by urban middle aged and elderly individuals.

Hypertension affects approximately 50 million individuals in the United States and approximately one billion individuals worldwide. As the population ages the prevalence of hypertension is likely to increase. Recent data from the Framingham heart study suggests that the individuals who are normotensive at 55 years of age have a 90% life time risk for developing hypertension.

Today's, fast hitech world has not even spared the eating and drinking habits of the masses. Cola drinks, chocolates, coffee etc have become ready to serve and consume snacks of the day. It's high time, hence, to dwell into the pharmaco therapeutic aspects and the effect of caffeine consumption on the human biological system. The intake of caffeine containing beverages in many adults and children often reaches levels that can induce pharmacological effects.

Caffeine is an alkaloid, which is a mild central nervous system, cardiac and respiratory system stimulant.

It is abundantly found in coffee, tea, cocoa nuts etc. When present in tea it is known as "thein". One standard cup of coffee on an average contains 75 mgs of caffeine.

When caffeine or coffee, is taken orally by a non-user or an abstainer, it causes a rise in both systolic and diastolic blood pressures. This effect is more pronounced in those who are already hypertensives. There is a prolonged increase in B.P by a single oral dose of caffeine in mildly hypertensive men (American Journal of Hypertension, Aug 1994).

Although considerable tolerance rapidly develops to the pressor effect of caffeine, the previous response is regained after a few hours (Shi et al, 1993). Those who drank five cups or more of coffee / day, have on an average, a 2.4/1.2 mm Hg higher B.P than those who abstain (Jee et al, 1999). In a 32 year follow-up of 1,017 former medical students, the incidence of hypertension was nearly threefold higher in those who drank 1 – 5 cups of coffee / day as compared to non-coffee drinkers (Mead et al, 1996). In contrast, increased caffeine intake, ascertained by multiple careful dietary results, was associated with lower B.P among the participants in the Multiple Risk Factor Intervention Trial (Stamler et al, 1997).

Stress has been shown to stimulate sympathetic nervous system, which could lead to hypertension. Among healthy employed men, job stress is associated with higher awake ambulatory B.P, an increased risk for developing hypertension, and an increased left ventricular mass index by echocardiography (Pickering, 1997), at least partly mediated by an increased heart rate in response to stress (Vrijkotte et al, 2000).

In a 10 year follow up of 103 young men, Light et al (1999) found the highest rises in B.P over time among those who responded most to

laboratory stresses and who also had a positive family history of hypertension and were exposed to higher level of daily stress.

In view of the evidence that, stress related anxiety (Jonas et al, 1997; Markovitz et al, 1995) and job stress (Pickering et al, 1996) may be involved in the development of hypertension, various stress-relieving techniques to lower B.P have been used for many years.

More recently, a variety of cognitive behavioral therapies – including transcendental meditation, yoga, biofeedback and psychotherapy, have been shown to reduce the B.P of hypertensive patients at least transiently (Henderson et al, 1998).

Standardized and reproducible stress procedure : -

1. Stroop colour card test.
2. Mental arithmatic test.

For the study of emotionally induced cardiovascular changes the aim is to use mild but adequate emotional stimuli that could be repeatedly applied and would give quantitatively reproducible effects on the forearm blood flow as well as on systolic and diastolic blood pressure. After many trials, a combination of the stroop procedure and mental arithmatic has proved sufficient.

Stroop in the year 1935 introduced a method to study pain of conflicting stimuli both being inherent aspect of the same symbols. The stroop color – word test has lately been used in various modified forms in many laboratory stress studies. The procedure is as follows : On a card the words red, blue, green and yellow are printed in different colours ; no word is printed in the color it indicates, but an equal number of times in each of the other three colors. Thus, each word presents the name of one color. Hence, a word stimulus and a color stimulus are presented simultaneously. The color-word test involves

interference between color – naming and word reading. The test card contains a hundred words. The patient being examined will have to first read aloud the words and then to name as quickly as possible the colours of the printed words.

After 2 – 3 minutes necessary for the stroop procedure, the subjects have to perform some mental arithmatic for 5 to 6 minutes. The test was given verbally to subjects, it consisted of repeated substraction of 7 from 1000. The total time of the whole mental stress situation was 8 – 10 minutes. The cardiovascular pattern during such a simple experimental emotional stress situation is in principle the same as the one observed during natural stress of day to day life (e.g. during quiet conversation, examination, hazardous situations, etc.). It is therefore possible to study problems of emotional stress with this model.

The sympathetic nervous system plays a critical role in the maintenance of normal body temperature during exposure to cold environment. Receptors in the skin and CNS respond to a fall in temperature, by activating hypothalamic and brainstem centers that increase sympathetic activity. The reflex responses activated by cold are controlled from the posterior hypothalamus. When cutaneous blood vessels are cooled, they become more sensitive to catecholamines and the arterioles and venules constrict. The sympathetic response involves a complex interaction between lower environmental temperature and α_2 –adrenergic receptors.

The cold pressor test assesses sympathetic function. The individual immerses one hand in ice water (1^0 to 4^0 C) and B.P is measured at 30 seconds and one minute. The systolic and diastolic pressures normally rise by 10 to 20 mm Hg. The afferent pathway is

spinothalamic and thus is distinct from the afferent limb of the baroreceptor reflex arc.

A study published in Journal of Human hypertension (Carrol D, Davey Smith G, et al Dec 1996) studied blood pressure reactions to the cold pressor test and the prediction of future blood pressure status, suggested that the cold pressor test may be of limited clinical use in older population.

Another study published in Journal of hypertension (Woisetschlager C. et al, April 2000) studied increased blood pressure response to the cold pressor test in pregnant women developing pre-eclampsia. They concluded that an increased vasoconstriction response to a physiological stimulus is present in women with pre-eclampsia as a sign of an increased vascular reactivity, prior to clinical manifestation of the disease. The cold pressor test may be a suitable diagnostic tool to identify women, who will develop pre-eclampsia.

The response of B.P during graded exercise has been found to predict the development of hypertension in normotensives (Matthews et al, 1998; Miyai et al, 2000; Singh et al, 1999) and there subsequently mortality from cardiovascular disease (Mundel et al, 1996; Kjeldsen et al, 2001).

Different upper limits for a normal response to exercise have been used in various series. Matthews et al (1998), considered an exaggerated response to be a rise of more than 60 mm of Hg in systolic BP at 5 minutes, a rise of more than 70 mm Hg at 10 minutes, or a rise of more than 10 mm Hg in diastolic BP at any time. In various series, such an exaggerated response increases the likelihood of the onset of hypertension from two to four fold over the subsequent 5 – 10 years as compared with that seen with non-exaggerated responses.

Even a rise in BP of more than 30 / 15 mm of Hg in anticipation of an exercise test, has been found to predict the onset of hypertension over the next four years (Everson et al, 1996).

Hypertension is taking its toll in today's world. Most of the middle-aged individuals presenting in the OPDs are either hypertensives or harbour a disease that has been borne of hypertension.

Caffeine is one of the ingredients of the common food and drink articles consumed, that significantly affect BP. Stress has become the part and parcel of the life of modern man, because of adoption of sedentary mode of life style. Exercise and physical activity have become stories of the past. To review, the role of autonomic nervous system in BP regulation in hypertensive individuals, I studied its trends by carrying out cold pressor test in my subjects.

So we decided to study the effect of Caffeine, Stress, Cold pressor test, Physical activity on blood pressure in middle aged (30 – 50 years) hypertensive individuals.

Aims

&

Objectives

Aims and Objectives

This study was designed to see the effect of Caffeine, Stress, Cold pressor test, Physical activity on blood pressure in middle aged (30 – 50 years) hypertensive individuals.

Review Of Literature

Review of Literature

Since there is no dividing line between normal and high BP : arbitrary levels have been established to define persons who have an increased risk of developing morbid cardiovascular event and / or will benefit from medical therapy. These definitions take into account levels of systolic and diastolic pressures, age, sex, race and concomitant diseases. The level of systolic pressure is also important in assessing the influence of arterial pressure on cardiovascular morbidity. Some data suggest that it may be more important than diastolic pressure. A reduction in mortality and morbidity with treatment, specifically in the elderly, has been documented in these patients. This beneficial effect results mainly from a reduction in strokes and occurs in women as well. Other significant demographic factors that modify the influence of BP on the frequency of morbid cardiovascular events and age, sex, race with young black males being most severely effected by severe hypertension.

Operational definition of Hypertension

Arterial pressure fluctuates in most persons, whether they are normotensives or hypertensives. Patients who are classified as having **Labile Hypertension** are those who sometimes; but not always, have arterial pressures in the hypertensive range. These patients are often considered to have borderline hypertension.

Sustained hypertension can become accelerated or enter a malignant phase, although that is unusual in treated patients.

Though a patient with **Malignant Hypertension** often has BP above 200 / 140 mm Hg, the condition is defined by the presence of papilledema, usually accompanied by retinal hemorrhages and exudates, rather than by absolute pressure levels.

Accelerated Hypertension is defined as a significant recent increase over the previous hypertensive levels associated with evidence of vascular damage on fundoscopic examination but without papilledema.

Resistant Hypertension is the failure to reach goal BP in patients who are adhering to full doses of an appropriate three drug regime which includes a diuretic.

THE SEVENTH REPORT OF JOINT NATIONAL COMMITTEE ON PREVENTION, DETECTION, EVALUATION AND TREATMENT OF HIGH BLOOD PRESSURE

The above report provides a new guideline for hypertension prevention and management. Following are the key messages :-

1. In persons older than 50 years, systolic BP of more than 140 mm Hg is a much more important cardiovascular disease risk factor than the diastolic BP.
2. The risk of cardiovascular disease beginning at 115 / 75 mm Hg, doubles with each increment of 20 / 10 mm Hg, individuals who are normotensive at 55 years of age have a 90% lifetime risk for developing hypertension.
3. Individuals with a systolic BP of 120 – 139 mm Hg or a diastolic BP of 80 – 89 mm Hg should be considered as hypertensives and require health promoting lifestyle modifications to prevent cardiovascular disease.

4. Thiazide type diuretics should be used in drug treatment for most patients with uncomplicated hypertension, either alone or combined with drugs from other classes. Certain high risk conditions are compelling indications for the initial use of other antihypertensive drug classes (Angiotensin converting enzyme inhibitors, angiotensin factor receptor blockers, β Blockers, Ca channel blockers).
5. Most patients with hypertension will require two or more antihypertensive medications to achieve goal BP (< 140 / 90 mm Hg, or less than 130 / 80 mm Hg for patients with diabetes or chronic kidney disease).
6. If BP is more than 20 / 10 mm Hg above goal BP; consideration should be given to initiating therapy with two agents, one of which usually should be a thiazide type diuretic.
7. The most effective therapy prescribed by the most careful clinician will control hypertension only if patients are motivated. Motivation improves when the patients have positive experiences with and trust in the clinician. Empathy builds trust and is a potent motivator.

Finally, in presenting these guidelines, the committee recognizes that the responsible physician's judgement remains paramount.

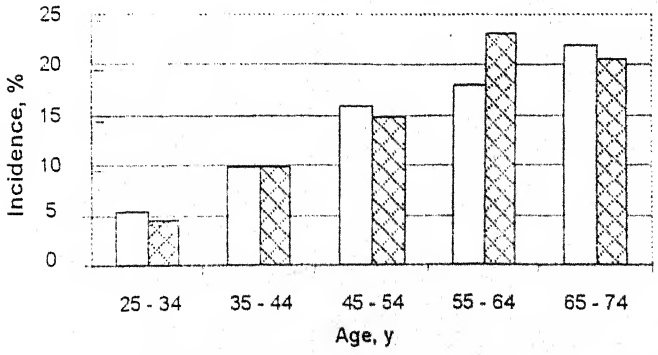
Classification of BP for adults aged 18 years or older as recommended by JNC VII.

BP classification	Systolic BP		Diastolic BP
Normal	< 120	and	< 80
Prehypertension	120 – 139	or	80 – 89
Stage 1 hypertension	140 – 159	or	90 – 99
Stage 2 hypertension	≥ 160	or	≥ 100

INCIDENCE OF HYPERTENSION

Much less is known about the incidence of newly developed hypertension than about its prevalence. The Framingham heart study provides one such database (Kannel et al, 1993; Vasan et al, 2001) and the National Health Epidemiologic follow up study another (Cornoni – Huntley et al, 1989).

As depicted in the bar graph below, comparison of the incidence of hypertension (Systolic BP ≥ 160 mm Hg ; Diastolic BP ≥ 95 mm Hg) in white men and women, shows an approximate 5% increase for each 10 year interval for age at baseline, except in the 65 – 74 years old age group. The incidence among blacks was atleast twice than amongst whites. The high incidence in the 55 – 64 years old and 65 – 74 years old groups likely represents a considerable proportion of isolated systolic hypertension, because the diagnosis was based on elevations in either systolic diastolic BP.



Incidence of hypertension in white men (open bars) and women (cross bars). Follow up averaged 9.5 years. (From Cornoni – Huntley et al 1989).

Rates of progression to hypertension in Framingham

Blood Pressure category	Percentage of 4 year progression to hypertension (95% confidence interval)			
	Men Age 35 – 64 years	Men Age 65 – 74 years	Women Age 35 – 64 years	Women Age 65 – 94 years
Optimal (SBP < 120 mm Hg and DBP < 80 mm Hg)	5 (4 – 6)	15 (12 – 20)	5 (4 – 6)	16 (12 – 21)
Normal (SBP < 130 mm Hg and DBP < 85 mm Hg)	18 (15 – 20)	25 (20 – 31)	12 (15 – 21)	26 (21 – 31)
High Normal (SBP 130 - 139 mm Hg and DBP 85 – 89 mm Hg)	37 (33 – 41)	47 (41 – 54)	37 (33 – 42)	49 (42 – 55)

(Data from Vasan et al, 2001)

As seen in the above table, the incidence of hypertension in Framingham Cohort was directly related to the prior level of BP and to age. (Vasan et al, 2000).

PREVALENCE OF HYPERTENSION

Hypertension effects approximately 50 million individuals in the U.S.A and approximately one billion individuals Worldwide (JNC VII report). As the population ages, the prevalence of hypertension will increase even further unless broad and effective preventive measures are implemented. Recent data from Framingham heart study suggests that individuals who are normotensives at 55 years of age have a 90% lifetime risk for developing hypertension.

CARDIOVASCULAR DISEASE RISK

Relationship between BP and cardiovascular disease events is continuous and consistent and independent of other risk factors. The higher the BP, the greater the chance of Myocardial Infarction, Heart Failure, Stroke and Renal diseases. For individuals aged 40 – 70 years each increment of 20 mm Hg in systolic pressure or 10 mm Hg in diastolic pressure doubles the risk of cardiovascular disease across the entire BP range from 115 / 75 to 185 / 115 mm Hg.

Following is a list of various cardiovascular risk factors and the nature of damage to the target organs -

Cardiovascular risk factors

Major risk factors

1. Hypertension
2. Cigarette smoking
3. Obesity (BMI ≥ 30)
4. Physical inactivity
5. Dyslipidemia
6. Diabetes mellitus
7. Microalbuminuria or estimated GFR < 60 ml/min
8. Age (> 55 years for men, > 65 years for women)
9. Family history of premature cardiovascular disease (men < 55 years or women 65 years)

Target-Organ Damage

A. Heart
   1. Left ventricular hypertrophy
   2. Angina or prior myocardial infarction
   3. Prior coronary revascularization
   4. Heart failure

B. Brain

   Stroke or transient ischemic attack

C. Chronic kidney disease

D. Peripheral arterial disease

E. Retinopathy

TYPES AND CAUSES OF HYPERTENSION

Systolic and Diastolic hypertension	Foods Containing Tyramine and Monamine Oxidase inhibitors
Primary, essential or idiopathic	Coarctation of aorta and aortitis
Identifiable causes	Pregnancy induced
Renal	Neurologic disorders
Renal parenchymal disease	Increased intracranial pressures
Acute glomerulo nephritis	Sleep apnea
Chronic nephritis	Quadriplegia
Polycystic disease	Acute porphyria
Diabetic nephropathy	Familial dysautonomia
Hydronephrosis	Lead poisoning
Renovascular disease	Guillain – Barre syndrome
Renal artery stenosis	ACUTE STRESS
Other causes of renal ischemia	Psychogenic hyperventilation
Renin producing tumors	Hypoglycemia
Renoprival	Burns
Primary Na retention (Liddle syndrome; Gordons syndrome)	Alcohol withdrawl
	Sickle cell crises
Endocrine	After resuscitation
Acromegaly	Perioperative
Hypothyroidism	Increased intravascular volume
Hyperthyroidism	Alcohol
Hypercalcemia (Hyperparathyroidism)	Nicotine
Adrenal disorders	Cyclosporine, Tacrolimus and
Cortical disorders	Other agents
Cushing's Syndrome	SYSTOLIC HYPERTENSION
Primary aldosteronism	Increased cardiac output
Congenital adrenal hypoplasia	Aortic valvular insufficiency
Medullary tumors (Pheochromocytomas)	Arteriovenous fistula, patent ductus
Extra adrenal chromaffain tumors	Thyrotoxicosis
11 β hydroxy steroid dehydrogenase deficiency or inhibition (licorice)	Pagets disease of bone
	Beriberi
Carcinoids	Arterial rigidity
Exogenous harmones	
Estrogen	
Glucocorticoids	
Mineralo corticoids	
Sympatho mimetics	
Erythropoietin	

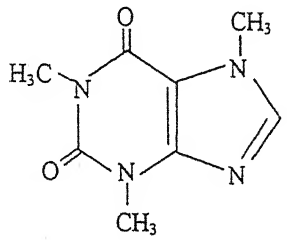
Hypertension induced by chemical agents

Mechanism	Examples
Expansion of fluid volume	
Increased sodium intake	Antacids, processed foods
Mineralocorticoid effects	Licorice
	Cortisone
	Anabolic steroids (Owens et al, 1998)
Stimulation of renin-angiotensin	Estrogens
Inhibition of prostaglandins	NSAIDs (Whelton et al, 2000)
Stimulation of sympathetic nervous activity	
Sympathomimetic agents	Caffeine (Hartley et al, 2000)
	Cocaine (Nzerue et al, 2000)
	Ephedrine (Haller and Benowitz, 2000)
	Methylenedioxymethamphetamine (MDMA, "ecstasy") (Lester et al, 2000)
	Methylphenidate (Ritalin) (Ballard et al, 1976)
	Nicotine (Sabha et al, 2000)
	Phencyclidine (Sernulan) (Eastman and Cohen, 1975)
	Phenylophrine (Lai, 1989)
	Phenylpropanolamine (Kernan et al, 2000)
Interactions with monoamine oxidase inhibitors	Foods with high tyramine content (e.g. red wines, aged cheese) (Liu and Rustgi, 1987), Parkinson's disease therapy (Ito et al, 2001)
Anesthetics	Ketamine (Broughton-Pipkin and Waldron, 1983)
Ergot alkaloids	Ergotamine (Joyce and Gubbay, 1986)
Dopamine receptor agonist	Bromocriptine (Bakht et al, 1990)
Antidopaminergic	Metoclopramide (Roche et al, 1985)
Sandostatin analog	Sandostatin LAR Depot (Octreotide acetate for injectable suspension, Pop-Busui et al, 2000)
Interference with antihypertensive drugs	
Inhibition of prostaglandin synthesis	NSAIDs (Whelton et al, 2000)
Inhibition of neuronal uptake (block clonidine, methyldopa)	Tricyclic antidepressants (Walsh et al, 1992)
Paradoxical response to antihypertensive drugs	
Withdrawl, followed by increased catechols	Clonidine (Metz et al, 1987)
Unopposed α-adrenergic vasoconstriction	B-Blockers (Drayer et al, 1976)
Intrinsic sympathomimetic activity	Pindolol (Collins and King, 1972)
Combination α- and β- blockers	Propranolol plus clonidine (Warren et al, 1992)
Unknown mechanisms	
Heavy metal poisoning	Lead (Bost et al, 1999)
	Mercury (Velzeboer et al, 1997)
	Thallium (Bank et al, 1992)
Chemicals	Carbon disulfide (Egeland et al, 1992)
	Arsenic (Rahman et al, 1999)
	Methyl chloride (Scharnweber et al, 1974)
	Polychlorinated biphenyl (Kreiss et al, 1981)
Insecticides	Parathion (Tsachalinas et al, 1971)
Insect bites	Spider (Weitzman et al, 1977)
	Scorpion (Gueron and Yaron, 1970)
Diagnostic agents	Indigo carmine (Wu and Johnson, 1969)
	Pentagastrin (Merguet et al, 1968)
	Thyrotropin-releasing hormone (Rosenthal et al, 1987)
Therapeutic agents	Cyclosporine (Zhang and Victor, 2000)
	Digitalis (Cohn et al, 1969)
	Disulfiram (Volicer and Nelson, 1984)
	Erythropoietin (Ni et al, 1998)
	Herbal remedies (Fugh-Berman, 2000)
	Indinavir (Cattelan et al, 2000)
	Lithium (Michaeli et al, 1984)
Alcohol	Alcohol (Tsuruta et al, 2000)

CAFFEINE

Caffeine is an alkaloid occurring in plants widely distributed geographically. At least half of the World population consumes tea and coffee, containing caffeine.

Chemically it is methylated Xanthine. Xanthine itself is a dioxy purine and is structurally related to uric acid. Caffeine is 1, 3, 7 – trimethyl xanthine. Structural formula of caffeine is :



The basis for the popularity of all the caffeine containing beverages is the ancient belief that they have stimulant and antisoporific action that elevate mood, decreases fatigue and increases capacity of work.

Caffeine is a mild CNS stimulant, is the most widely used psychoactive drug in the World. It is present in Cola drink, Coffee, Tea, Cocoa, Chocolate and numerous prescription and over the counter drugs.

It increases non-epinephrine secretion and enhances neural activity in numerous brain areas.

Caffeine is absorbed from the digestive tract; it is rapidly distributed throughout the body tissues. Volume of distribution being 0.4 Lts / Kg and it easily crosses the placental barrier. Maximum plasma concentration are achieved within one hour.

Caffeine has a half life of 3 – 7 hours in plasma.

Approximate amount of Caffeine in various drinks :

One cup of Coffee	75 mgs
One cup of Tea	50 mgs
One cup of Coco	4 mgs
200 ml of Cola drink	30 mgs

Many of the effects of Caffeine are believed to occur by means of competitive antagonism at adenosine receptors. Studies have demonstrated that caffeine is A_1 and A_2 adenosine receptor antagonist found in brain, heart, lungs, peripheral vessels and platelets (Arquivos Brasileiros de Cardiologia 75(2); 97-105, Aug 2000). Adenosine is a neuromodulator that influences a number of functions at the CNS. The mild sedating affect that occurs when adenosine activates particular adenosine receptor subtypes can be antagonised by caffeine.

Tolerance occurs rapidly to the stimulating effects of caffeine. Thus ; a mild withdrawl syndrome has been produced in the control studies by abrupt cessation of as little as one to two cups of coffee / day. Caffeine withdrawl consists of feeling of fatigue and sedation.

With higher doses headache and nausea have been reported during withdrawl; vomiting is rare (Silverman et al, 1992).

Systemic effects of Caffeine : Caffeine administered acutely in excess of 250 mgs to a non-user or recent obstainer can induce : Restlessness, Nervousness, Excitement, insomnia, Flushed face, Hypertension, diuresis, GI disturbances, muscle twitching, tachycardia or cardiac arrhythmias.

Serious intoxication may cause delerium, seizures, supraventricular and ventricular tachyarrhythmias, hypokalemia and hyperglycemia.

Effect of caffeine on BP

Acute effects on BP

Caffeine, consumed daily by approximately 80% of adults in coffee, tea, or cola drinks, acutely raises both systolic and diastolic blood pressure from 5 – 15 mm Hg for several hours in some but not all subjects, more in hypertensives than normotensives (Rachima Maoz et al, 1998).

Single oral dose of caffeine (3.3 mg/Kg equivalent to 2-3 cups of coffee) on BP on hypertensives and appropriate normotensives for 3 hours. Systolic BP s were significantly higher after caffeine for both groups for the entire 3 hours, whereas, the increment in diastolic BP became smaller in normotensive group 90 minutes after caffeine ingestion (American Journal of Hypertension, Aug 1994).

Results suggest that coffee consumption may affect both diagnosis and treatment of hypertension and abstinence from caffeine may be beneficial, especially for hypertensive individuals.

Acute BP elevations with caffeine in men with borderline hypertension were 2 to 3 times more as compared to normotensive controls (American Journal of Cardiology, Feb 1996).

Tea would raise BP even more than would be expected from its caffeine content (Hodgson et al, 1990). The effect likely reflects vasoconstriction by antagonism of endogenous adenosine and increased arterial wave reflection (Vlachopoulos and D' Rourke, 2000). The pressor effect is exaggerated in hypertensives (Pincomb et al, 1996) and is additive to the pressor effect of nicotine (Narkientez et al, 1996).

This acute pressor effect has long been recognized but downplayed, mainly because tolerance rapidly develops, so that less pressor effect occurs with repeated intakes (Myers and Reeves, 1991).

However, with in 12 hours, tolerance is largely overcome, setting the stage for a significant pressor effect from the first morning cup of coffee (James, 1997). Most observation studies find little if any association (Kleenola et al, 2000; Sesso et al, 1999).

Chronic effects on BP

To assess the effect of repeated chronic caffeine intake, ambulatory BP monitoring has been performed on both normo and hypertensive subjects, who consumed 3 – 5 cups of either caffeinated or decaffeinated coffee per day. Most of these studies find an increase in 24 hours BP of approximately 5/3 mm Hg in hypertensives with caffeinated coffee (Jee et al, 1999 ; Rakic et al, 1999).

A study published in American Journal of Cardiology in 1994 ; April 15 aiming to find the effects cessation of caffeinated coffee consumption on ambulatory and resting blood pressure in men showed that the resting heart rates were not different between the groups before and after intervention. In comparison the decaffeinated coffee group revealed significant reduction in mean ambulatory systolic BP and reduction in mean diastolic BP during the afternoon and evening hours and no change in ambulatory heart rate.

Because responses may vary, it seems prudent to ask patients to test their own response by measuring home BP repeatedly during a week, while consuming either their usual amount of caffeinated or decaffeinated beverage. If a significant pressor effect is seen, substitution of decaffeinated beverages should be recommended.

STRESS

Stress is the interaction between the demands or changes in our life and our ability to adjust to them. For example : driving on the freeway at rush hour is more stressful for most of us than driving on a country road. It is the way we react to events, rather than the events themselves, that causes stress. When we lose the sense that we can handle or adjust to events in our life, we experience stress. Stress can be positive (happiness) or negative (anxiety), physical (exercise) or emotional. Our bodies respond to undergoing physiological changes, such as increased heart rate, blood pressure and hormone production. An event can be both positive and negative at the same time, such as a new house or a new job.

Stress is a normal part of everyday living, and helps make life interesting and meaningful. Not all stress is bad. We need a certain amount in our lives to keep us motivated, but chronic stress, of an intense and negative nature can have a detrimental effect on the heart.

Body responds to stress by increasing the heart rate, BP rises, respiratory rate increases, pupils become larger and vision sharper, hearing improves. It may also lead to inability to concentrate, headache, backache, stomach ache, prespiration, cold clammy hands, insomnia, withdrawl, irritability, impatience, anger, fatigue, feeling of uneasiness, anxiety and loss of control. Constant negative stress can lead to high blood pressure, ulcers, migraine, angina, heart attacks, backache or sexual problems.

Some of the major stressors are :

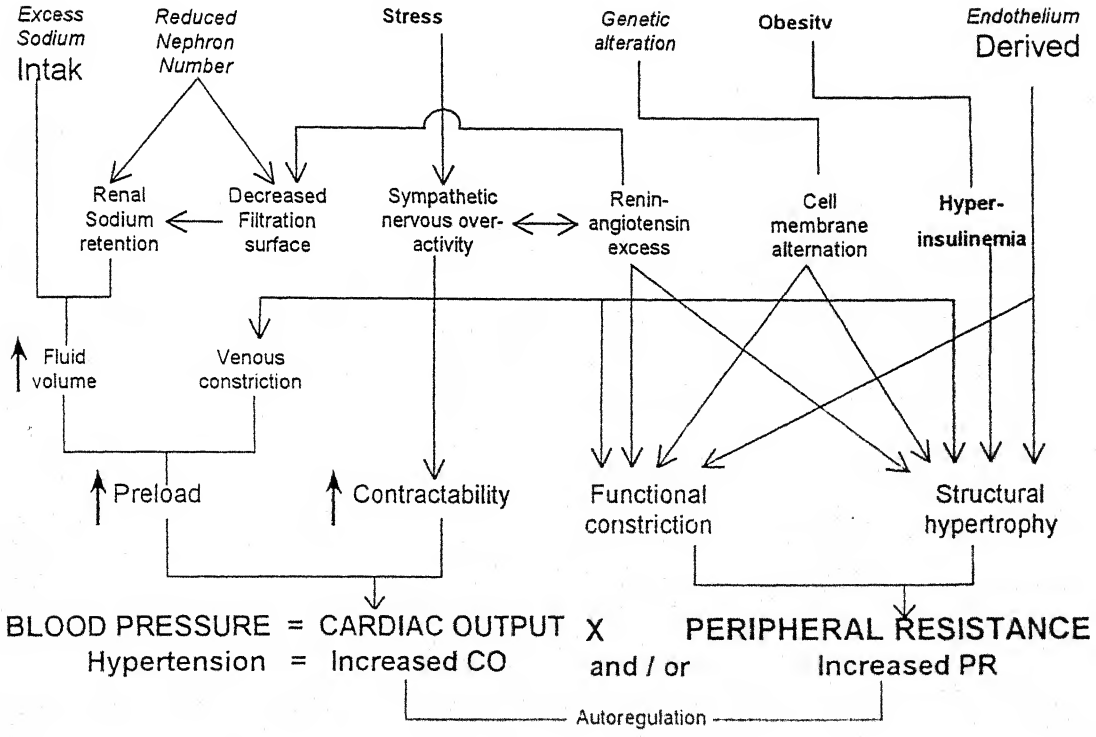
Major changes : Promotion, new baby, new house, new job, marriage, divorce.

Annoyances : Traffic, crowds, movie, illness, death.

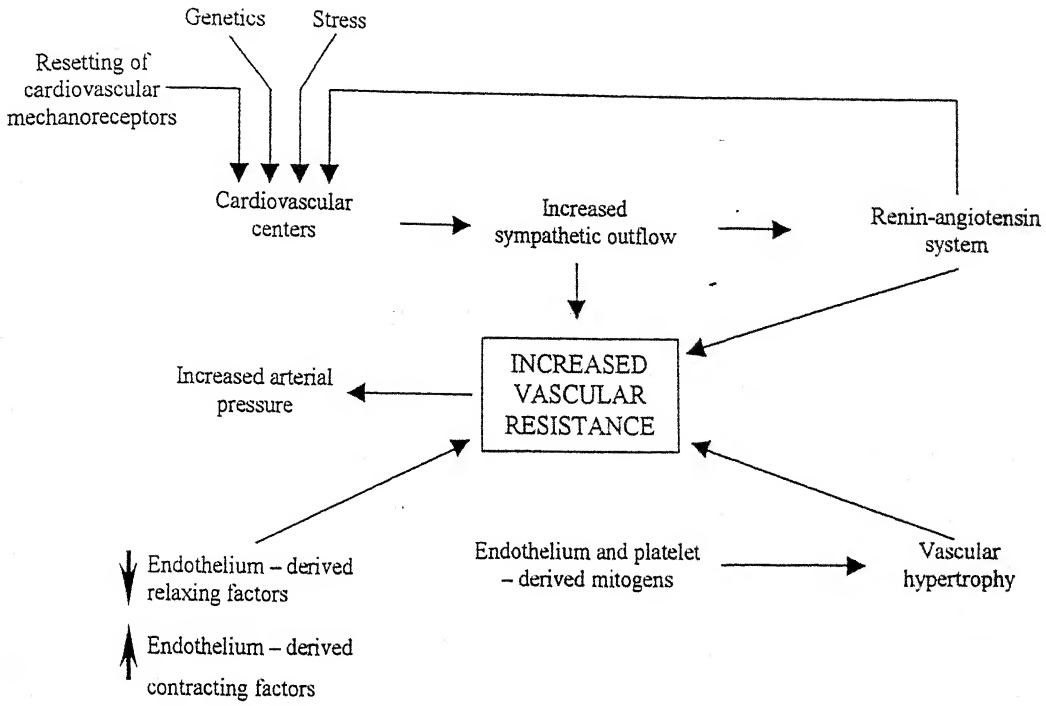
Lack of Control / helplessness : Illness.

Sensory overload : Too many things going at once, threat to safety, security or self-esteem, unrealistic goals, time pressures and relationship.

Relationship between Stress and Blood Pressure



Stress and overactivity of the sympathetic nervous system



As shown an excess of renin and angiotensin activity could interact with Sympathetic nervous system to mediate most of its affects. In contrast, stress may activate the Sympathetic nervous system directly ; and Sympathetic nervous system overactivity, intern, may interact with high sodium intake, the Renin Angiotensin Aldosterone system and insulin resistance, among other possible mechanisms. Considerable evidence supports increased Sympathetic nervous system activity in early hypertension (Esler et al, 2001) and, even more impressively, in the still normotensive offspring of hypertensive parents, among whom a large number are likely to develop hypertension.

As the above figure shows Sympathetic nervous system overactivity could lead to hypertension, and stress is an obvious stimulant of the Sympathetic nervous system.

Exposure to Stress : Multiple studies support that people exposed to repeated psychogenic stresses may develop hypertension more frequently than would otherwise similar people who are not stressed : Air traffic controllers, who work under high level psychological stress, anually develop hypertension at a rate 5.6 times greater than that of non-professional pilots, who are initially comparable to the controllers in physical characteristics (Cobbs and Rose, 1973).

Among healthy employed men, job strains is associated with higher awake ambulatory BP, an increased risk for developing hypertension, and an increased left ventricular mass index by echocardiography (Pickering, 1997) at least partly mediated by an increased heart rate in response to stress (Vrijkotte et al, 2000).

A study for blood pressure responses to acute stress and left ventricular mass, concluded that in their cohort of hypertensive middle aged men and women, BP reactivity did not predict LV mass. Positive association of systolic with relative wall thickness suggest that exaggerated reactivity may particularly be related to LV changes influenced by vascular tone.

(American Journal of Cardiology, 2002 March)

A study on blood pressure reactions to acute psychological stress and future blood pressure status with a 10 years follow up concluded that the results of the study provided modest support for the hypothesis that heightened blood pressure reactions to mental stress contribute to the development of high blood pressure. At the same time, they question the clinical utility of stress testing as a prognostic device

(Psychosomatic Medicine, Sept – Oct 2001).

COLD PRESSOR TEST

Measurement of the skin temperature is a useful index of vasomotor function. Vasomotor paralysis results in vasodialation of skin vessels and a rise in skin temperature. Normal skin temperature is 31 – 33^0 C when the room temperature is 26 – 27^0 C. Vasoconstriction lone may also be listed by measuring the skin temperature of the area in question before and after immersing one or both hands in cold water.

The integrity of sympathetic reflex arc – which includes barorecptors in aorta and carotid sinus, their afferent pathways, the vasomotor centres, and the sympathetic and parasympathetic outflow can in general be listed by combining the following :-

- Cold pressor test
- Grip test
- Mental arithmatic test
- Valsalva maneuver

COLD PRESSOR TEST :

The cold pressor test assesses sympathetic function. The individual immerses one hand in ice water (1 – 4^0 C) and his BP is measured in 30 seconds and 1 minute. The systolic and diastolic BP s usually rise by 10 – 20 mm Hg. The afferent pathway is spinothalamic and thus is distinct from the afferent limb of the barorecptor reflex arc. When spinothalamic pathways are intact and abnormal responses indicates an abnormality of autonomic central processing or sympathetic efferent function. When the response to cold pressor test is normal and to Valsalva abnormal the lesion is located in the afferent limb of the baroreceptor reflex arc.

If the vasomotor centres of brain are operating properly, both systolic and diastolic blood pressures will increase upto 10 – 20 mm Hg. In hypertensive individuals the rise may be as high as 30 – 40 mm Hg.

Hypertension may appear during various acute physical stresses, usually indicating an intense sympathetic discharge and sometimes the contribution of increased renin-angiotensin from volume contraction. Significant hypertension has been observed in patients with various acutely stressed medical conditions as after exposure to cold (Wilmhurt et al, 1987).

Study by R.S.Taylor et al (2001), aiming at testing the seasonal cold and circadian changes in BP and physical activity in young and elderly people concluded that time of day – winter increases BP in older people may be related to increased activity as well as to the level of ambient temperature. Although it is generally advantageous for the older people to be physically active in order to prevent circulatory disease, there may be a rationale for advising that they should avoid intense activity at certain times of the day, especially in the winters.

Blood pressure reactions to cold pressor test and the prediction of future blood pressure status (Journal of Human Hypertension, Dec 1996) suggested that the cold pressor test may be of limited clinical use in older populations.

During cold pressor test reduced blood pressure increases have been observed in diabetic patients and have been attributed to an impaired efferent sympathetic function (Diabetes Care, July 1996).

EFFECT OF PHYSICAL ACTIVITY ON BLOOD PRESSURE

The systemic cardiovascular response to exercise depends on whether the muscle contractions are primarily isometric or primarily

isotonic with the performance of external work. With the start of an isometric muscle contraction, the heart rate rises, after few seconds systolic and diastolic BP rise sharply. Stroke volume changes relatively little, and blood flow to the steadily contracting muscle is reduced as a result of compression of their blood vessels.

The response to exercise involving isotonic muscle contraction is similar in that there is a prompt increase in heart rate but different in that there is a marked increase in stroke volume. In addition, there is a net fall in total peripheral resistance due to vasodilation in exercising muscles. Consequently systolic BP rises only moderately, whereas diastolic pressure usually remains unchanged or falls.

Cardiac output is increased during isotonic exercise to values that may exceed 35 L / Minute, the amount being proportionate to the increase in Oxygen consumption.

Blood pressure during exercise : The response of BP during graded exercise has been found to predict the development of hypertension in normotensives (Matthews et al, 1998; Miyai et al, 2000; Singh et al, 1999) and their subsequent mortality from Cardiovascular disease (Mundal et al, 1996; Kjeldsen et al, 2001). Different upper limits for a normal response to exercise have been used in various series. Matthews et al (1998) consider an exaggerated response to be rise of more than 60 mm Hg in systolic BP at 5 minutes, a rise of more than 70 mm Hg at 10 minutes, or a rise of 10 mm Hg in diastolic BP at any time. In various series, such an exaggerated response increases the likelihood of the onset of hypertension from two to four fold over the subsequent 5 to 10 years, as compared with that seen with non-exaggerated responses.

Even a rise in BP of more than 30/15 mm Hg in anticipation of an exercise test has been found to predict the onset of hypertension over the next four years (Everson et al, 1996).

Exaggerated rises of Blood pressure during exercise : Based on an average of 8.8 years, follow up of healthy normotensive men, it has been noted that those who developed hypertension were 3 times more likely than matched controls to have an exaggerated BP response during a graded maximal exercise test (Matthews et al, 1998).

Blood Pressures that are in the higher ranges of normal : As perhaps best seen data from the Framingham cohort the BP tends to track over many years, remaining in the same relative portion over time (Kotchen et al, 1982). After an initial regression towards the mean between the first examination and the second, two years later subjects in each BP segment tend to remain in that segment, with a slow, gradual rise over the 14 years of follow up.

In a later survey of the Framingham population, hypertension developed over a 4 year interval in only 5% of men and women, with optimal BP (< 120/80 mm Hg), in 18% with a normal BP (< 130/85 mm Hg), and in 37% with high normal BP (130 – 139/85 – 89 mm Hg) (Vasan et al, 2000).

In a study the affect of autonomic nervous system activity on exaggerated systolic BP response to exercise in healthy subjects using heart rate variability showed that the sympathetic activity was higher at rest and during the total exercise period, parasympathetic activity was lower during the total exercise period in healthy subjects with exaggerated Systolic blood pressure response to exercise than in those with normal Systolic blood pressure response.

(Acta cardiologica, June 2000).

In another study conducted by Nishiyam T et al in November 2001 to study the affects of a rhythmic muscle compression on arterial BP at rest and during dynamic exercise in humans, the results suggested that the rhythmic increase in intramuscular pressure that occurs during dynamic exercise evokes a pressor response in humans

(Acta Physiologica Scandinavica, Nov 2001).

Material

&

Methods

Material and Methods

This study was conducted on hypertensive individuals between 30 – 50 years of age, who were either attending the hypertension clinic or were admitted in the wards of M.L.B. Medical College, Hospital, Jhansi. Both male and female subjects were included in the study. Normotensive individuals of similar age group were treated as control subjects.

Detailed history was taken from all the patients of hypertension, to know the duration of symptoms, year of diagnosis, family history of hypertension, any complications and treatment undertaken previously.

Personal History including Name, Age / Sex, religion, education, occupation, smoker or non-smoker, drinking habits, socio-economic status, marital status and number of kids were enquired.

Family History of diabetes and hypertension were enquired for, in maternal and paternal side.

Present History

Detection of hypertension, age at which detected, what has been the course, risk factors like smoking, tobacco chewing, obesity, alcoholism, emotional stress, high fat diet, operation (renal diseases), diabetes mellitus, pregnancy induced hypertension, pregnancy associated hypertension.

Drug History

Intake of steroids, oral contraceptives, vaso pressors, treatment taken or not, dietary precaution, drug dosage and duration, whether continued the treatment or interrupted. Whether a regular coffee drinker or not and if yes then the approximate amount per day.

Dietary History : - Vegetarian or non-vegetarian. Approximate consumption of fat per week.

General Examination was done to look for any particular facies, buffalo hump, weight, height, body mass index, pulse rate, arterial wall, radio femoral delay, other peripheral pulses, BP (systolic/diastolic) – 2 readings after 15 minutes of rest in sitting position, odema (dependant / periorbital), xanthelasma, tendon xanthoma, arcus senilis, temperature, icterus, clubbing, pallor oedema (dependent / periorbital), cyanosis, hydration and lymphadenopathy.

Criteria of Hypertension : - All patients between the age group 30 to 50 years with the BP of > 139 / 89 mm Hg were included in the study. They were categorized according to JNC VII as :

	Systolic BP	Diastolic BP
Stage 1 hypertension	140 – 159	90 - 99
Stage 2 hypertension	≥ 160	≥ 100

Criteria of Controls : - Normotensive individuals with a blood pressure of less than 120 mm Hg systolic and less than 80 mm Hg diastolic, of same age and sex were considered as controls.

Measurement of Blood Pressure :- Patient was initially rested for 15 minutes, then he was made to be seated comfortably with the forearm supported such that the arm was positioned at the level of the heart. Initially the BP was measured in both the arms and the one with higher BP was taken for records. A mercury sphygmomanometer was used to

measure the BP. While recording the BP international standards of BP measurement (Cuff corresponding to approximately 2/3rd of arm length, lower edge of Cuff approximately 2.5 cms above the anticubital fossa and the bladder long enough to encircle at least 80% of the arm), taking special care that the brachial artery is properly occluded. The pressure of bladder was raised approximately 20 mm of Hg above the systolic level as was indicated by disappearance of radial pulse because patients might have an auscultatory gap related to increased arterial stiffness. The Cuff was deflated at a rate of 2 – 4 mm of Hg per second. Disappearance of the sound (phase 5) was taken as the end point as against muffling (phase 4).

Effect of Caffeine on Blood pressure : - 50 gms of coffee powder was made into 20 standard cups of Coffee. Patients and controls were asked to drink the coffee and blood pressure was recorded after 30 and 60 minutes.

To study the effect of stress on blood pressure a standardized and reproducible stress procedure like Stroop color-word test and mental arithmatic test were used.

Stroop color card test : - It is a laboratory method of inducing stress. On a card the words red, blue, green and yellow are printed in different colours ; no word is printed in the color it indicates, but an equal number of times in each of the other three colors. Thus, each word presents the name of one color. Hence, a word stimulus and a color stimulus are presented simultaneously. The color-word test involves interference between color – naming and word reading. The test card contains a hundred words. After 5 minutes of Stroops procedure mental arithmetic test was done.

Mental arithmatic test : - This task was given verbally to the subjects and they were asked to keep on substracting 7 from 500. After 3 minutes of arithmatic mental stress i.e., after 8 minutes of total stress, BP was recorded. This method was adopted both for subjects and controls.

To study the effect of cold pressor test, subjects and controls were asked to dip their left hand in ice cold water (0 - 4^0 C) upto wrist, for 1 minute. Thereafter BP was recorded in the same arm.

To study the effect of physical activity on blood pressure : - Blood pressure was measured after 15 minutes of rest. Then the subjects and controls were asked to climb 4 flights of stairs containing 44 stairs within 45 seconds. Thereafter the blood pressure was recorded. Lastly the results were summarized and compared with control group.

Working Performa

Name : Age / Sex :

Religion : Occupation :

Smoker / Non-smoker :

Alcoholic / Non-alcoholic :

Socio-economic status :

Marital status :

Children :

Family History of Hypertension :

(1). Paternal side :

(2). Maternal side :

Present history :

1. Detection of hypertension :

   Age at which detected :

2. Risk Factors :

   (a). Smoking (f). High fat diet

   (b). Tobacco chewing (g). Operation if any (Renal iseases)

   (c). Obesity (h). Diabetes mellitus

   (d). Alcoholism (i). Pregnancy induced Hypertension

   (e). Emotional stress (j). Pregnancy associated HTN

3. History of drug intake :

   Steroids

   Oral contraceptives

   Vaso-pressors

   Others

4. Treatment taken or not

If Yes, kind of treatment.

General Examination :

Weight : Height :

BMI :

Pulse :

1. Rate
2. Rhythm
3. Character
4. Volume
5. Radio femoral delay
6. Arterial wall

Pallor : Oedema :

Icterus : Xanthalasma :

Cyanosis : Tendon Xanthoma :

Clubbing : Arcus senilis :

1. BP in sitting position after 15 minutes of rest

   1st Reading : 2nd Reading :

2. BP after ingestion of 1 cup of strong coffee (after 30 minutes and 60 minutes)

3. BP after 15 minutes of rest

   1st Reading : 2nd Reading :

4. BP after mental stress by Stroop card test (for 5 minutes) and by mental arithmatic test (after 3 minutes)

5. BP after 15 minutes of rest

   1st Reading : 2nd Reading :

6. BP after climbing 4 flights of stairs within 45 seconds

7. BP after 15 minutes of rest

   1st Reading : 2nd Reading :

8. BP after immersion of left hand in ice cold water ($0 - 4^0$ C) for 1 minute.

Observations

Observations

A total number of 65 patients were included in the present study, who were attending either hypertension clinic, or were admitted in the hospital, M.L.B Medical College, Jhansi. A similar number of normotensive individuals of the same sex and age were considered as controls.

Table No. 1

Distribution according to sex of the patients

Sex	No. of patients	Percentage
Male	42	65
Female	23	35

Table number 1 shows that out of 65 patients, 42 (65%) were males, and 23 (35%) were females. Same was the number and percentage in the control group. The male : female ratio was 13 : 7.

Table No. 2

Distribution of controls and subjects according to blood pressure

Hypertension	No. of patients	Percentage
Normontensives (Systolic < 120 mm Hg and Diastolic < 80 mm Hg)	65	100
Stage I hypertension (Systolic ≥ 140 - 159 mm Hg or Diastolic ≥ 90 - 99 mm Hg)	39	60
Stage II hypertension (Systolic ≥ 160 mm Hg or Diastolic ≥ 100 mm Hg)	26	40

Table number 2 shows that, there were 65 normotensive individuals, having systolic blood pressure < 120 mm Hg and diastolic blood pressure < 80 mm Hg, and they were considered to be as controls.

Whereas, in the study group a total of 65 hypertensives, 39 patients (60%) were stage I hypertensives having systolic blood pressure ≥ 140 – 159 mm Hg, or diastolic blood pressure ≥ 90 – 99 mm Hg.

26 patients (40%), were stage II hypertensives having systolic blood pressure ≥ 160 mm Hg and diastolic blood pressure ≥ 100 mm Hg. This classification was done according to JNC VII report.

Table No. 3

Age wise distribution of cases

Age group	Number of controls		Number of cases	
30 – 35 years	10	15.38	10	15.38
36 – 40 years	17	26.15	17	26.15
41 – 45 years	14	21.54	14	21.54
46 – 50 years	24	36.93	24	36.93

Table number 3 shows that, there were 24 (36.93%) patients in the age group 46 – 50 years, 17 patients (26.15%) in age group 36 – 40 years, 14 (21.54%) patients in age group 41 – 45 years and 10 (15.38%) were in 30 – 35 years age group.

Similar were the number of individuals of different age groups in the control group.

Table No 4

Effect of Caffeine on Systolic Blood pressure

	After 30 minutes	After 60 minutes
In controls	1.3 mm Hg	1.5 mm Hg
In subjects	2.2 mm Hg	2.89 mm Hg

Table number 4 depicts, that in the study group there was a rise of 2.2 mm Hg (t value = 7.13; p value < 0.05) and a rise of 2.89 mm Hg (t value = 8.58; p value < 0.05) of systolic blood pressure after 30 and 60 minutes of caffeine ingestion respectively.

On comparing the rise in systolic blood pressure in subjects, with those in the controls after 30 minutes (z value = 2.4; p value < 0.05) and 60 minutes (z value = 3.53; p value < 0.05) of caffeine ingestion, it was found that the rise in the case group was significant (p value < 0.05).

Table No 5

Effect of Caffeine on Diastolic Blood pressure

	After 30 minutes	After 60 minutes
In controls	0.6 mm Hg rise	1.41 mm Hg
In subjects	0.12 mm Hg fall	2.06 mm Hg

Table number 5 depicts, that in the study group there was a fall of 0.12 mm Hg (t value = 0.69; p value > 0.05) and a rise of 2.06 mm Hg (t value = 8.54; p value < 0.05) of diastolic blood pressure after 30 and 60 minutes of caffeine ingestion respectively.

On comparing the above alterations in diastolic blood pressure in subjects, with those in the controls after 30 minutes (z value = 2.6; p value < 0.05) and 60 minutes (z value = 1.93; p value > 0.05) of caffeine ingestion, it was found that the fall in diastolic blood pressure after 30 minutes of caffeine ingestion was significant (p < 0.05),

whereas the rise of diastolic blood pressure after 60 minutes of caffeine ingestion, was statistically insignificant (p value > 0.05).

Table No. 6

Effect of Mental stress on Systolic Blood pressure

In controls	4.49 mm Hg
In subjects	5.69 mm Hg

It was observed from table number 6 that, there was a rise of 5.69 mm Hg and 4.49 mm Hg of systolic blood pressure in subjects and controls respectively, after mental stress (z value = 3.44; p value < 0.05).

Table No. 7

Effect of Mental stress on Diastolic Blood pressure

In controls	1.63 mm Hg
In subjects	2.03 mm Hg

Table no 7 shows that, there was a rise of 2.03 mm Hg and 1.63 mm Hg of diastolic blood pressure in subjects and controls respectively, after mental stress (z value = 1.35; p value < 0.05).

Table No. 8

Effect of Cold pressor test on Systolic Blood pressure

In controls	13.10 mm Hg
In subjects	13.81 mm Hg

It was observed from table number 8 that, there was a rise of 13.81 mm Hg and 13.10 mm Hg of systolic blood pressure in subjects and controls respectively, after cold pressor test (z value = 0.927; p value > 0.05).

Table No. 9

Effect of Cold pressor test on Diastolic Blood pressure

In controls	6.21 mm Hg
In subjects	4.18 mm Hg

Table no 9 depicts that, rise in diastolic blood pressure of the subjects was 4.18 mm Hg and in controls 6.21 mm Hg of diastolic blood pressure after cold pressor test (z value = 4.19; p value < 0.05).

Table No. 10

Effect of Physical stress on Systolic Blood pressure

In controls	23.84 mm Hg
In subjects	39.07 mm Hg

It was evident from table 10 that, there was a rise of 39.07 mm Hg and 23.84 mm Hg of systolic blood pressure in subjects and controls respectively. This was seen after they were asked to climb 44 stairs (z value = 11.27; p value < 0.05).

Table No. 11

Effect of Physical stress on Diastolic Blood pressure

In controls	0.36 mm Hg
In subjects	3.50 mm Hg

Table no 11 shows that, there was a rise of 3.50 mm Hg and 0.36 mm Hg of diastolic blood pressure in subjects and controls respectively, after they underwent physical stress test (z value = 3.95; p value < 0.05).

Table No. 1 : Showing the sex ratio of the patients

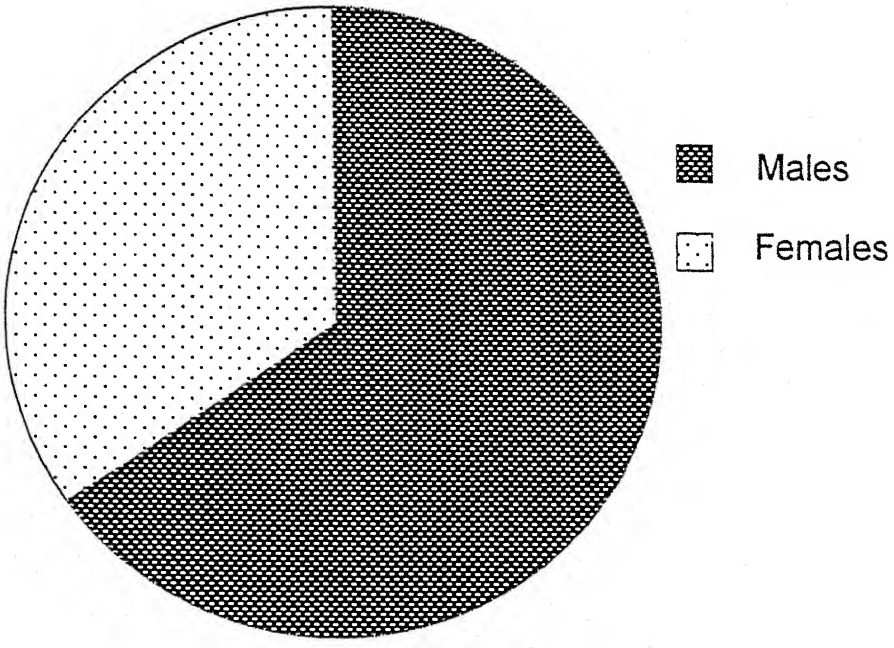


Table No. 2 : Showing the percentage of cases and controls according to blood pressure

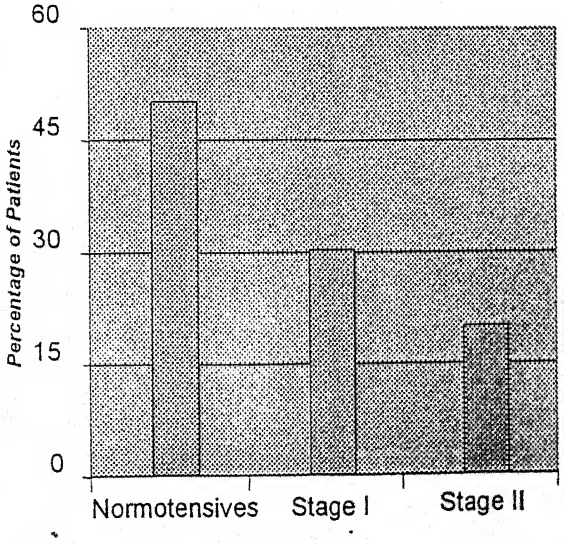


Table No. 3 : Age wise distribution of cases and controls

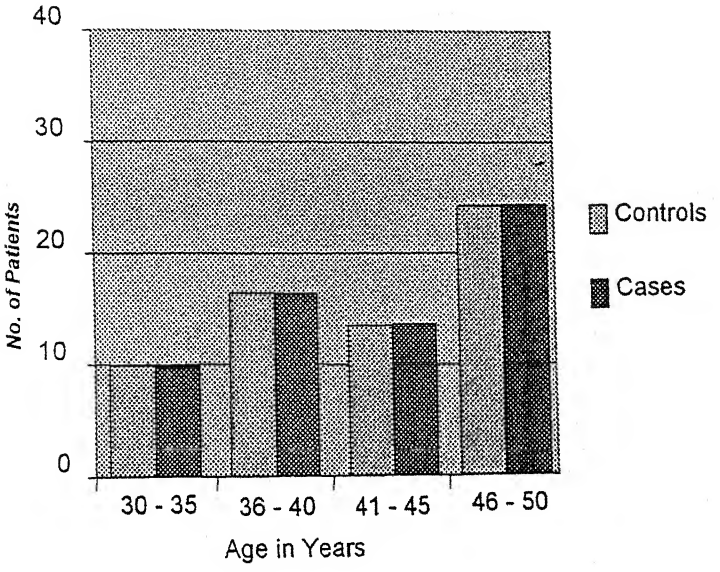


Table No. 4 : Effect of caffeine on systolic blood pressure

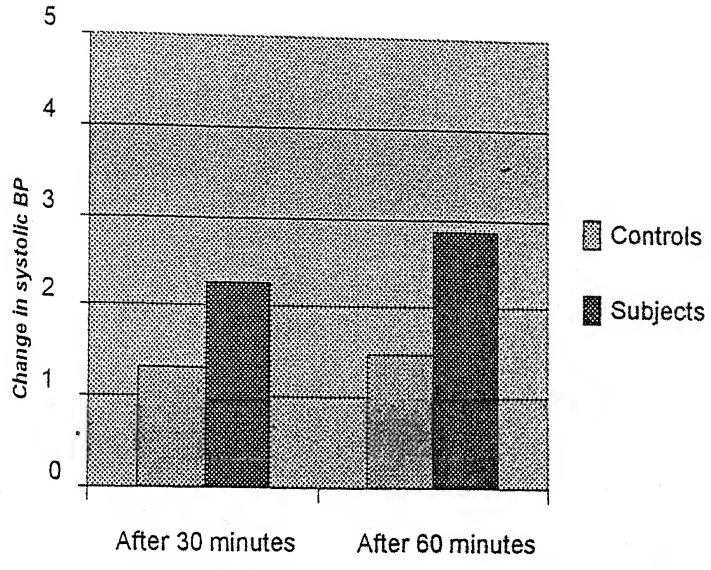


Table No. 5 : Effect of caffeine on diastolic blood pressure

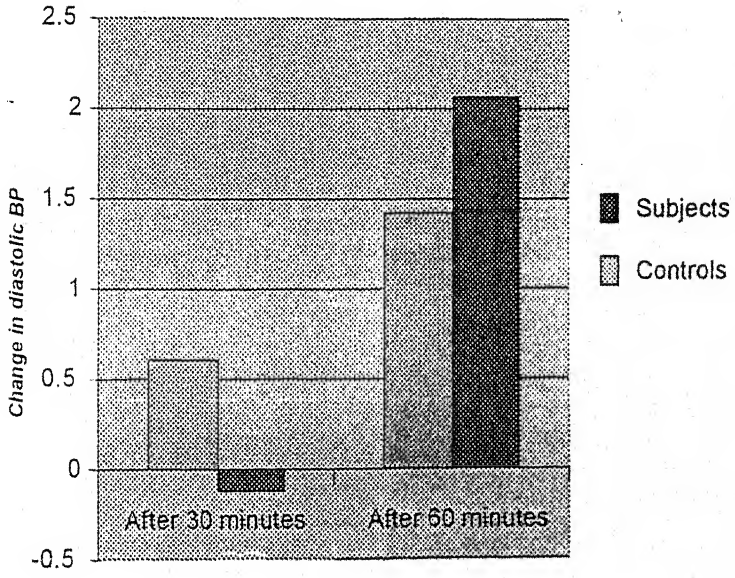


Table No. 6 : Effect of mental stress on systolic blood pressure

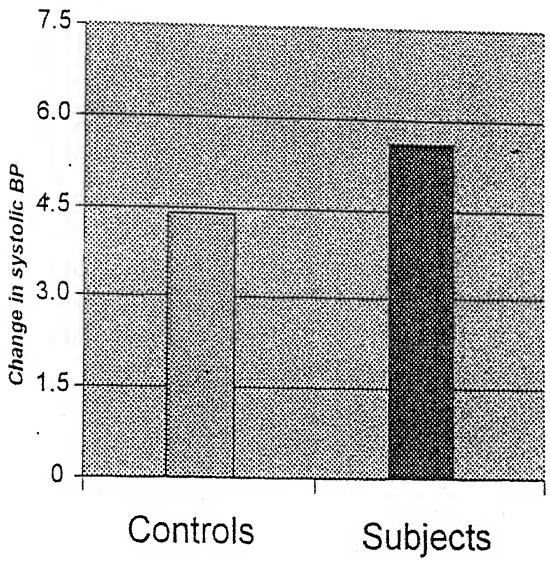


Table No. 7 : Effect of mental stress on diastolic blood pressure

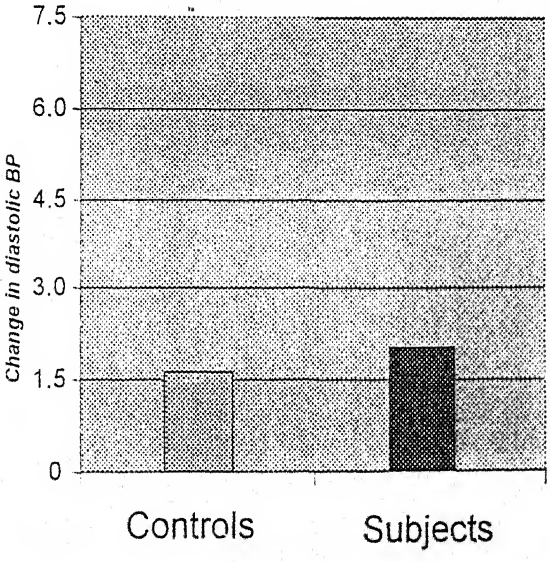


Table No. 8 : Effect of Cold pressor test on systolic blood pressure

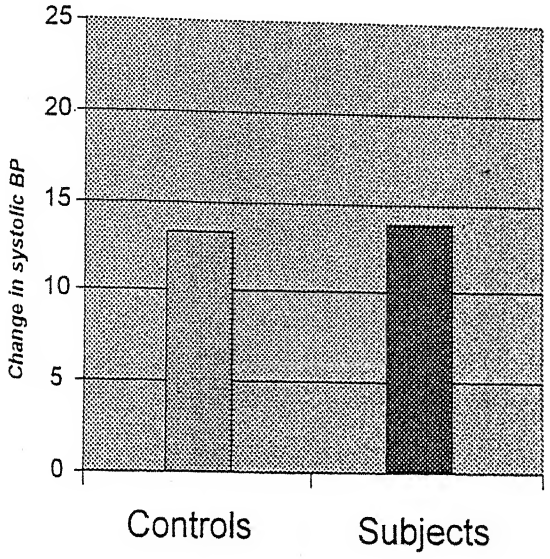


Table No. 9 : Effect of Cold pressor test on diastolic blood pressure

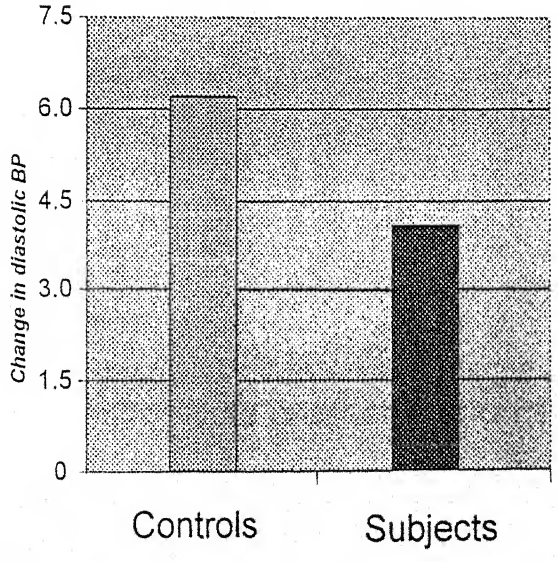


Table No. 10 : Effect of Physical stress on systolic blood pressure

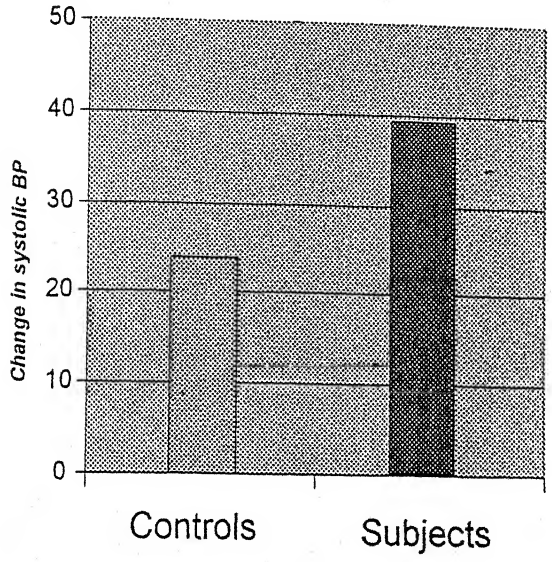
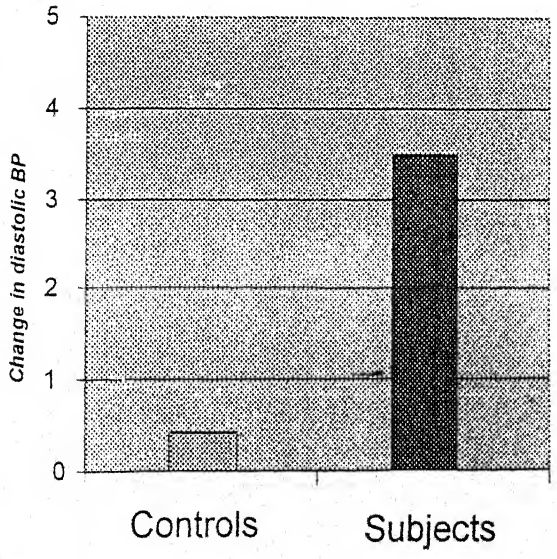


Table No. 11 : Effect of Physical stress on diastolic blood pressure



Discussion

Discussion

A total number of 65 hypertensive individuals were included in the present study, who were attending either hypertension clinic or were admitted in the hospital M.L.B. Medical College, Jhansi. A similar number of normotensive individuals of the same sex and age were considered as controls.

In the present study incidence of hypertension was more in males (65%), as compared to females (35%) in the age group 30 to 50 years, in the present study male : female ratio was 13 : 7. Similar results were reported by Cornoni – Huntley J et al (1989) in The National Health and Nutrition Examination Survey I Epidemiologic follow up study.

In this study of the total of 65 hypertensive individuals 39 patients (60%) were stage I hypertensives having systolic blood pressure ≥ 140 – 159 mm Hg, or diastolic blood pressure ≥ 90 – 99 mm Hg.

26 patients (40%), were stage II hypertensives having systolic blood pressure ≥ 160 mm Hg and diastolic blood pressure ≥ 100 mm Hg.

As the stage of hypertension increase the percentage of population in that particular group decreases. This was shown in the study conducted in 1993 by National High Blood Pressure Education Program Working group.

There were 24 (36.95%) patients in the age group 40 – 50 years, 17 patients (26.15%) in age group 36 – 40 years, 14 (21.54%) patients in age group 41 – 45 years and 10 (15.38%) were in 30 – 35 years age group. Similar were the number of individuals of different age groups in the control group.

Incidence of hypertension rises with age as was shown by Cornoni- Huntley J et al (1989).

In our study the percentage of individuals in the age group 36 – 40 years were more than those in age group 41 – 45 years, this was probably because we have classified the groups with a small class interval leading to overlapping of the groups.

In the study group there was a mean rise of 2.2 mm Hg in the subjects (t value 7.13; p value < 0.05) and a rise of 2.89 mm Hg (t value 8.58; p value < 0.05) of systolic pressure after 30 and 60 minutes of caffeine ingestion respectively.

On comparing the rise in systolic blood pressure in subjects with those in the controls after 30 minutes (z value 2.4; p value < 0.05) of caffeine ingestion, it was found that the rise in the case group was significant (p value < 0.05).

Hartley TR, Sung BH et al while studying the hypertension risk status and effect of caffeine on blood pressure concluded that the strongest response to caffeine was observed among diagnosed men; followed by the stage I and high normal groups and then by the normal and optimal groups.

Effect of caffeine in this study revealed that there was a significant rise (t value=8.54; p value <0.05) of 2.06 mg in diastolic BP after 60 minutes of coffee ingestion in the study group.

Also after 30 minutes of caffeine ingestion there was a fall of 0.12 mg which was statistically not significant (p>0.05).

Mazurek W, Negrusz-Kawecka M while studying the effect of coffee on blood pressure revealed that drinking one cup of coffee caused after 60 minutes, to 2 hours elevated systolic and after 60 minutes diastolic pressure only in hypertensive patients. Thus the insignificant fall in the subjects after 30 minutes in this study could be

because either the readings were taken too early i.e., 30 minutes or because in the above study ambulatory blood pressure monitors were used while in this study we used a manual BP instrument.

On studying the effect of mental stress on BP by mental arithmetic test and stroop card test it was seen that there was a rise of 5.69 mm Hg and 4.49 mm Hg of systolic blood pressure in subjects and controls respectively, (Z value=3.44; p value <0.05).

Similarly there was a rise of 2.03 mng and 1.63 mng of diastolic pressure in subjects and controls respectively, after mental arithmetic test (Z value=1.35; p value <0.05).

Sympathetic nervous system overactivity could lead to hypertension, and stress is an obvious stimulant of the sympathetic nervous system.

According to Markovitz et al (1998); Saab et al (2001); Steptoe and Cropley (2000) greater cardiovascular and sympathetic nervous system reactivities to various laboratory stress have been documented in hypertensives and in normotensives at higher risk for developing hypertension.

Light et al (1999) found highest rises in BP over time among those who responded most to laboratory stresses and who had a positive family history of hypertension and were exposed to higher levels of daily stress.

The effect of cold pressor test in hypertensive individuals and normotensive individuals were similar i.e. the rise in hypertensive individuals was insignificant (Z value=0.927; p value >0.05).

This may be explained as cold pressor test is a test to determine autonomic dysfunction; it has nothing to do with previous absolute blood pressure status.

According to Wilmhurst et al, 1989 significant hypertension has been observed in individuals after exposure to cold. But when this rise in blood pressure was compared in both normotensives and hypertensive individuals; the rise in systolic BP hypertensives came out to be insignificant.

In the present study there was a significant rise ($p<0.05$) of 39.07 mm Hg in subjects as compared to a rise of 23.84 mng in controls in systolic BP (Z value=11.27; p value <0.05).

There was a rise of 3.50 mm Hg and 0.36 mm Hg of diastolic blood pressure in subjects and controls respectively, after they underwent physical stress test (Z value=3.95; p value <0.05).

According to Mattheues et al (1998); Miyai et al (2000), Singh et al (1999) the response of blood pressure during graded exercise has been found to predict the development of hypertension in normotensives. An exaggerated response increases the likelihood of the onset of hypertension from two to fourfold over subsequent 5 to 10 years as compared with that seen with non exaggerated response.

Conclusion

Conclusions

In this study 65 hypertensive individuals were studied for the effect of caffeine, physical stress, cold pressure test and physical activity on their blood pressure and the results were compared with normotensive individuals of same age and sex. The following conclusion was drawn from the present study:

1. Caffeine ingestion is associated with rise in both systolic and diastolic blood pressure if ingested acutely by an abstainer. The rise in systolic & diastolic blood pressure is more after 60 minutes of ingestion. This rise is more marked in hypertensives as compared to normotensives. Therefore hypertension risk status should take priority in future research regarding pressure effects of dietary intake of caffeine.
2. Caffeine consumption may affect both diagnosis and treatment of hypertension.
3. Mental stress is associated with a significant rise of blood pressure in hypertensive individuals when compared with normotensive individuals.
4. Effect of cold pressure test in hypertensive individuals is similar to those in normotensives individuals; the rise when compared with normotensives is statistically insignificant.
5. The rise of blood pressure (both systolic and diastolic) after physical activity is more in hypertensives as compared to normotensives and the rise is statistically significant.

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Master Chart

MASTER CHART

Sl. No.	Names	Age/sex	Resting BP	After Coffee		Resting BP	After stress	Resting BP	After CPT	Resting BP	After PA
				30 min	60 min						
1	Raja beti	30 / F	148 / 92	154 / 90	152 / 92	142 / 90	148 / 92	146 / 90	160 / 96	144 / 94	172 / 100
2	Shakuntala	30 / F	96 / 60	96 / 60	98 / 60	96 / 60	100 / 62	94 / 62	118 / 70	92 / 66	116 / 64
3	Vijay Verma	31 / M	160 / 94	164 / 92	164 / 96	166 / 92	172 / 94	162 / 96	168 / 96	164 / 90	188 / 94
4	Chunni Lal	31 / M	116 / 74	118 / 74	118 / 76	112 / 74	116 / 74	114 / 72	130 / 80	120 / 78	144 / 76
5	Vijay Gupta	31 / M	156 / 80	158 / 80	158 / 82	150 / 82	156 / 86	152 / 82	170 / 90	154 / 80	168 / 84
6	Sushil	31 / M	114 / 76	116 / 76	114 / 76	118 / 72	122 / 76	116 / 74	128 / 80	112 / 76	126 / 70
7	Chandan	32 / M	142 / 88	142 / 88	142 / 90	142 / 88	146 / 88	140 / 90	156 / 90	144 / 86	168 / 88
8	Horilal	32 / M	102 / 64	102 / 64	100 / 64	100 / 64	104 / 68	104 / 62	122 / 70	100 / 66	124 / 66
9	Dayaram	32 / M	158 / 96	164 / 94	162 / 96	158 / 96	164 / 98	156 / 98	170 / 100	160 / 100	196 / 104
10	Dinesh Kumar	32 / M	114 / 76	114 / 76	114 / 78	110 / 76	116 / 80	112 / 78	116 / 84	116 / 80	134 / 80
11	Sandeep	32 / M	144 / 84	144 / 82	144 / 84	148 / 84	150 / 84	146 / 82	164 / 84	142 / 86	168 / 88
12	V.N. Tiwari	32 / M	90 / 72	90 / 72	92 / 72	96 / 70	100 / 70	92 / 74	106 / 80	94 / 68	122 / 70
13	Pankaj Soni	33 / M	166 / 90	166 / 90	170 / 92	168 / 90	172 / 90	170 / 88	188 / 88	164 / 92	212 / 80
14	Pramod Gupta	33 / M	112 / 78	112 / 78	114 / 78	110 / 76	116 / 76	110 / 78	130 / 84	116 / 76	136 / 74
15	Ram Manohar	35 / M	160 / 96	164 / 96	166 / 98	164 / 96	170 / 96	162 / 94	180 / 98	158 / 98	194 / 100
16	Kishori Lal	35 / M	124 / 80	124 / 80	124 / 84	120 / 80	124 / 80	122 / 78	132 / 82	118 / 76	132 / 80
17	Rati Devi	35 / F	176 / 104	180 / 106	182 / 108	176 / 100	180 / 102	180 / 102	194 / 104	178 / 100	220 / 110
18	Shiv Kumari	35 / F	116 / 74	118 / 74	116 / 72	116 / 74	120 / 76	118 / 70	128 / 76	120 / 68	148 / 70
19	A.K Gupta	35 / M	176 / 100	180 / 102	180 / 104	176 / 96	178 / 96	178 / 92	190 / 96	178 / 94	220 / 86
20	Rajeev Jain	35 / M	116 / 80	116 / 80	118 / 84	116 / 80	120 / 80	112 / 78	124 / 84	114 / 82	142 / 74
21	Kiran	36 / F	148 / 88	148 / 88	146 / 88	150 / 88	156 / 90	146 / 86	154 / 92	152 / 82	176 / 88
22	Sita Devi	36 / F	110 / 70	112 / 70	112 / 70	112 / 76	116 / 78	108 / 74	112 / 78	110 / 72	136 / 70
23	Ram Swaroop	36 / M	166 / 90	166 / 92	168 / 92	164 / 90	170 / 92	162 / 88	172 / 96	160 / 90	208 / 96
24	Kalyan	36 / M	90 / 60	90 / 62	90 / 64	96 / 64	100 / 64	92 / 62	110 / 70	94 / 64	118 / 60
25	Bhagwati	36 / F	150 / 88	152 / 88	152 / 88	146 / 84	152 / 84	148 / 86	156 / 90	152 / 88	210 / 90
26	Ram Kumari	36 / F	120 / 76	122 / 76	120 / 78	116 / 76	120 / 80	118 / 74	134 / 80	120 / 72	140 / 74
27	B.S. Rana	36 / M	150 / 90	150 / 90	150 / 88	154 / 90	160 / 92	152 / 88	180 / 96	148 / 88	176 / 84

28	B.P. Singh	36 / M	110 / 70	110 / 70	110 / 72	110 / 72	114 / 74	108 / 70	116 / 76	112 / 74	130 / 80
29	Saira	36 / F	158 / 86	158 / 84	158 / 88	160 / 86	166 / 90	156 / 80	170 / 82	162 / 84	198 / 86
30	Yashodha	36 / F	104 / 70	104 / 70	104 / 72	110 / 70	114 / 72	102 / 68	118 / 74	106 / 72	134 / 70
31	Pramod Kumar	36 / M	148 / 90	146 / 88	148 / 92	146 / 88	146 / 86	144 / 90	168 / 98	150 / 92	176 / 90
32	V.K. Nayak	36 / M	98 / 60	100 / 60	100 / 60	94 / 56	100 / 60	96 / 58	110 / 64	92 / 62	120 / 64
33	Betibai	37 / F	176 / 108	178 / 106	178 / 108	170 / 104	176 / 106	174 / 106	180 / 110	178 / 110	210 / 112
34	Sarjoo	37 / F	106 / 64	110 / 64	110 / 64	100 / 60	104 / 62	104 / 62	112 / 68	102 / 60	124 / 64
35	Lad Kunwar	37 / F	152 / 90	152 / 90	152 / 92	154 / 90	160 / 92	150 / 88	164 / 94	156 / 88	198 / 90
36	Meena Devi	37 / F	116 / 78	118 / 78	116 / 80	116 / 80	120 / 82	110 / 78	126 / 84	112 / 76	138 / 78
37	Jiteendra Jain	37 / M	164 / 92	168 / 90	168 / 94	160 / 92	166 / 94	162 / 90	176 / 90	158 / 94	184 / 98
38	Bhuri Lal	37 / M	104 / 70	106 / 70	104 / 74	104 / 76	106 / 72	106 / 72	110 / 76	102 / 74	132 / 76
39	Suraj	38 / M	150 / 96	148 / 96	152 / 96	144 / 96	150 / 98	148 / 94	158 / 100	146 / 92	190 / 98
40	Hiralal	38 / M	100 / 70	100 / 70	98 / 70	100 / 70	114 / 72	104 / 68	118 / 72	102 / 72	130 / 70
41	R Dayal	38 / M	166 / 98	168 / 98	168 / 102	166 / 100	170 / 100	164 / 102	176 / 104	162 / 96	214 / 104
42	M Ikram	38 / M	118 / 76	120 / 76	118 / 76	120 / 76	126 / 78	116 / 72	134 / 80	122 / 74	138 / 74
43	Poornima	39 / F	174 / 96	176 / 96	178 / 98	180 / 96	184 / 96	176 / 98	192 / 106	178 / 94	224 / 102
44	Amina	39 / F	104 / 68	110 / 70	108 / 70	110 / 70	116 / 72	106 / 66	120 / 76	108 / 72	134 / 78
45	Johra Khatoon	39 / F	180 / 90	186 / 92	188 / 96	184 / 94	194 / 98	182 / 92	196 / 92	178 / 88	236 / 98
46	Shabnam	39 / F	100 / 74	104 / 74	100 / 76	100 / 72	106 / 76	98 / 70	116 / 76	102 / 70	124 / 72
47	Raj Kishor	39 / M	170 / 98	172 / 98	174 / 100	170 / 98	176 / 100	168 / 96	176 / 98	168 / 100	206 / 88
48	Bhanu Pratap	39 / M	110 / 72	110 / 74	110 / 74	108 / 70	112 / 72	110 / 68	118 / 78	108 / 72	124 / 66
49	Munni Devi	40 / F	152 / 90	154 / 92	150 / 94	148 / 90	156 / 94	150 / 92	168 / 100	154 / 88	188 / 86
50	Pista Devi	40 / F	112 / 70	114 / 70	114 / 74	110 / 76	114 / 76	114 / 72	128 / 78	110 / 74	134 / 70
51	Sanjay Singh	40 / M	156 / 90	158 / 88	158 / 92	160 / 92	170 / 96	158 / 88	170 / 92	154 / 94	202 / 100
52	Deepak Kumar	40 / M	104 / 80	104 / 80	106 / 84	100 / 80	106 / 84	102 / 78	114 / 86	98 / 76	126 / 70
53	Ritu Saini	40 / F	192 / 98	202 / 98	204 / 104	188 / 96	192 / 98	194 / 98	212 / 108	190 / 94	240 / 106
54	Neelam	40 / F	100 / 68	100 / 70	102 / 70	104 / 70	108 / 72	102 / 70	116 / 78	100 / 72	132 / 70
55	Babulal	41 / M	146 / 78	146 / 78	152 / 82	148 / 70	150 / 72	144 / 74	160 / 82	150 / 80	188 / 80
56	Kallu	41 / M	118 / 80	120 / 80	124 / 82	118 / 76	122 / 78	116 / 78	128 / 84	114 / 80	138 / 80

57	Kusum	41 / F	160 / 94	166 / 92	164 / 96	164 / 94	170 / 96	162 / 92	174 / 96	168 / 90	202 / 98
58	Saroj	41 / F	116 / 74	116 / 74	118 / 76	110 / 74	112 / 74	114 / 72	120 / 76	112 / 76	128 / 76
59	R Pachoria	41 / M	158 / 86	158 / 84	158 / 84	164 / 90	172 / 94	166 / 88	178 / 92	160 / 90	192 / 88
60	M.M Singh	41 / M	110 / 74	110 / 74	112 / 74	110 / 70	110 / 72	116 / 68	130 / 76	114 / 70	134 / 70
61	Sonu	42 / M	168 / 88	170 / 88	172 / 90	164 / 88	166 / 90	166 / 86	180 / 90	170 / 90	208 / 86
62	S.C Agarwal	42 / M	102 / 66	104 / 66	104 / 68	104 / 66	110 / 70	106 / 64	116 / 70	104 / 68	138 / 60
63	Mubina	43 / F	144 / 96	144 / 94	146 / 96	146 / 90	152 / 92	142 / 94	154 / 98	140 / 92	176 / 98
64	Rani	43 / F	110 / 70	110 / 70	112 / 70	110 / 70	116 / 72	112 / 72	124 / 80	108 / 68	130 / 68
65	Mohd. Jumman	43 / M	140 / 96	140 / 94	138 / 96	146 / 96	150 / 100	142 / 92	154 / 94	138 / 98	170 / 98
66	B.Shankar	43 / M	120 / 76	122 / 76	120 / 78	118 / 76	122 / 78	120 / 74	136 / 82	116 / 76	136 / 72
67	A.M Khan	43 / M	150 / 86	154 / 84	148 / 88	154 / 86	160 / 88	152 / 88	172 / 92	148 / 90	196 / 98
68	Madanlal	43 / M	114 / 74	116 / 76	116 / 74	110 / 72	110 / 74	112 / 74	128 / 80	116 / 78	140 / 82
69	Rajaram	44 / M	144 / 76	144 / 76	146 / 78	150 / 76	160 / 80	148 / 72	158 / 72	148 / 78	176 / 74
70	Faizal Ahmad	44 / M	118 / 72	118 / 72	120 / 74	120 / 76	124 / 72	122 / 70	130 / 80	116 / 74	138 / 76
71	Girja Bai	44 / F	184 / 110	188 / 110	190 / 112	178 / 110	182 / 112	180 / 106	198 / 108	182 / 108	230 / 122
72	Premwati	44 / F	114 / 72	116 / 72	114 / 72	112 / 72	116 / 74	110 / 70	122 / 78	108 / 72	136 / 70
73	Prem Gupta	44 / M	142 / 90	144 / 88	144 / 92	144 / 92	148 / 96	140 / 90	158 / 98	146 / 90	188 / 90
74	Janak	44 / M	112 / 70	110 / 70	112 / 72	110 / 74	114 / 78	112 / 74	130 / 80	108 / 72	128 / 70
75	Raghubeer	45 / M	154 / 88	152 / 86	154 / 90	154 / 90	164 / 92	152 / 88	166 / 94	150 / 90	206 / 102
76	Dhaniram	45 / M	100 / 76	98 / 76	100 / 78	106 / 74	110 / 76	102 / 72	116 / 80	104 / 74	136 / 78
77	Deshrani	45 / F	160 / 96	162 / 98	164 / 98	164 / 96	170 / 98	162 / 94	180 / 100	168 / 90	216 / 98
78	Kashibai	45 / F	120 / 80	122 / 80	124 / 76	120 / 78	126 / 80	118 / 76	128 / 78	122 / 78	144 / 78
79	Kiran	45 / F	146 / 102	144 / 100	146 / 100	150 / 100	160 / 102	148 / 98	156 / 98	152 / 104	198 / 110
80	Shahida	45 / F	110 / 70	110 / 74	110 / 72	110 / 70	116 / 72	108 / 68	122 / 64	112 / 72	132 / 70
81	Vishnu Devi	45 / F	156 / 90	156 / 88	156 / 90	156 / 92	162 / 96	152 / 88	168 / 90	152 / 90	184 / 90
82	Parvinder Singh	45 / F	118 / 78	120 / 78	120 / 80	120 / 76	122 / 76	122 / 76	140 / 86	116 / 74	128 / 70
83	G Harris	46 / M	146 / 86	146 / 86	148 / 88	144 / 84	150 / 88	148 / 88	166 / 90	150 / 86	190 / 86
84	R.N. Srivastava	46 / M	90 / 76	90 / 76	92 / 78	94 / 76	100 / 78	92 / 74	108 / 82	88 / 72	100 / 78
85	Mohd. Asif	46 / M	156 / 94	158 / 94	154 / 92	160 / 94	168 / 98	158 / 90	170 / 94	162 / 92	204 / 98

86	Mohd. Kamal	46 / M	106 / 70	110 / 70	106 / 70	110 / 70	116 / 68	108 / 68	120 / 70	104 / 72	124 / 74
87	A. Thomas	46 / M	150 / 92	152 / 94	152 / 94	156 / 90	160 / 92	154 / 88	168 / 90	152 / 94	196 / 100
88	Vimal Upadhayay	46 / M	106 / 70	106 / 70	106 / 68	110 / 70	116 / 72	108 / 68	116 / 74	104 / 72	130 / 68
89	Kasturi	47 / F	164 / 80	166 / 80	168 / 84	168 / 80	172 / 80	166 / 78	184 / 88	170 / 84	212 / 90
90	Sangeeta	47 / F	112 / 80	114 / 80	114 / 82	110 / 80	114 / 80	116 / 80	130 / 88	114 / 78	142 / 76
91	Chaturbhuj	47 / M	156 / 84	158 / 84	160 / 86	154 / 84	160 / 88	152 / 82	164 / 90	158 / 86	200 / 88
92	Hariom	47 / M	110 / 68	112 / 74	112 / 70	110 / 68	114 / 70	108 / 66	126 / 72	112 / 70	140 / 78
93	Jalim Singh	47 / M	152 / 94	154 / 92	156 / 96	150 / 94	156 / 94	154 / 90	168 / 100	148 / 92	192 / 96
94	Saurabh	47 / M	108 / 76	108 / 76	110 / 76	110 / 74	116 / 80	108 / 72	120 / 80	110 / 74	136 / 78
95	Ramkali	48 / F	148 / 90	152 / 90	152 / 92	150 / 90	156 / 92	152 / 88	168 / 92	150 / 92	188 / 96
96	Kanti	48 / F	116 / 74	114 / 74	118 / 76	110 / 70	114 / 74	112 / 72	126 / 80	114 / 72	132 / 72
97	Dhund Singh	48 / M	150 / 92	154 / 90	152 / 94	158 / 90	160 / 92	152 / 88	168 / 90	152 / 92	190 / 94
98	Khuda Baksh	48 / M	100 / 72	100 / 76	98 / 72	102 / 70	106 / 72	98 / 68	114 / 74	100 / 70	126 / 74
99	Sunil Kumar	48 / M	168 / 96	174 / 98	170 / 100	168 / 96	176 / 98	164 / 98	180 / 98	170 / 94	212 / 98
100	Jameel	48 / M	108 / 68	110 / 68	110 / 70	110 / 72	116 / 74	106 / 70	110 / 74	112 / 66	136 / 66
101	Sanjeev Gupta	48 / M	160 / 92	162 / 94	164 / 96	166 / 90	170 / 94	162 / 88	180 / 88	164 / 94	200 / 92
102	Ashok Kumar	48 / M	118 / 76	120 / 76	118 / 78	118 / 72	124 / 70	116 / 74	132 / 78	120 / 70	146 / 74
103	P.C Gupta	48 / M	152 / 96	154 / 96	154 / 96	150 / 94	156 / 96	154 / 92	162 / 98	152 / 98	202 / 98
104	Raj Kishor	48 / M	118 / 78	120 / 76	118 / 76	116 / 80	120 / 80	112 / 80	128 / 86	114 / 82	140 / 80
105	Aneesh	49 / M	144 / 80	146 / 78	146 / 82	140 / 80	146 / 80	142 / 78	156 / 80	140 / 76	176 / 86
106	Chaman Lal	49 / M	120 / 80	120 / 80	124 / 80	116 / 80	120 / 82	114 / 74	128 / 76	122 / 76	144 / 82
107	Waseem	49 / M	184 / 96	190 / 98	192 / 100	186 / 96	190 / 100	182 / 98	196 / 104	190 / 94	226 / 100
108	Bishan Singh	49 / M	108 / 70	108 / 72	110 / 72	110 / 70	112 / 70	106 / 68	120 / 76	112 / 72	138 / 72
109	Manohar	49 / M	158 / 80	162 / 82	162 / 82	160 / 84	170 / 86	156 / 82	166 / 84	162 / 88	196 / 96
110	J Prasad	49 / M	106 / 72	110 / 70	110 / 72	110 / 76	116 / 80	102 / 74	112 / 76	104 / 70	130 / 74
111	Kripa Devi	49 / F	158 / 88	162 / 88	162 / 94	160 / 90	168 / 92	154 / 88	168 / 90	158 / 90	188 / 90
112	Usha	49 / F	118 / 66	120 / 66	120 / 68	116 / 60	120 / 64	120 / 70	136 / 76	116 / 68	132 / 68
113	Vineeta	49 / F	140 / 80	140 / 82	144 / 82	140 / 84	146 / 86	138 / 88	150 / 96	144 / 86	178 / 88
114	Ramwati	49 / F	110 / 56	112 / 56	110 / 56	108 / 60	110 / 60	106 / 62	112 / 70	102 / 60	138 / 68

115	Dharmendra	49 / M	180 / 92	188 / 94	186 / 96	176 / 90	182 / 92	178 / 94	196 / 104	182 / 88	232 / 98
116	Jeewan Singh	49 / M	106 / 60	110 / 64	106 / 68	110 / 68	116 / 72	108 / 66	120 / 70	104 / 64	130 / 68
117	Maya Devi	49 / F	160 / 90	162 / 90	164 / 92	166 / 90	170 / 92	162 / 90	178 / 90	164 / 92	208 / 96
118	Vidhya Devi	49 / F	100 / 66	104 / 66	104 / 66	98 / 64	102 / 64	96 / 66	102 / 68	102 / 64	144 / 64
119	Lalchand	50 / M	172 / 104	176 / 108	178 / 110	172 / 100	178 / 102	178 / 102	184 / 108	174 / 100	216 / 108
120	Sudarshan	50 / M	118 / 76	120 / 78	122 / 80	120 / 76	126 / 76	116 / 74	124 / 82	122 / 72	144 / 70
121	Ayub Khan	50 / M	160 / 94	158 / 94	162 / 94	160 / 90	168 / 94	162 / 92	170 / 100	158 / 88	202 / 86
122	Ashiq Ali	50 / M	112 / 74	112 / 76	114 / 76	110 / 74	114 / 74	114 / 72	128 / 80	110 / 70	136 / 76
123	Babulal	50 / M	152 / 92	154 / 92	158 / 96	156 / 90	160 / 90	154 / 94	168 / 94	148 / 88	170 / 96
124	Ajay Kumar	50 / M	112 / 80	116 / 84	118 / 84	112 / 80	116 / 82	114 / 78	132 / 86	116 / 80	140 / 82
125	Malkhan Singh	50 / M	148 / 92	150 / 94	152 / 96	150 / 90	156 / 90	146 / 88	158 / 90	152 / 94	190 / 100
126	Ghanshyam	50 / M	116 / 80	116 / 84	118 / 84	112 / 76	116 / 78	114 / 76	132 / 82	118 / 78	136 / 76
127	K.K. Kulsheshtra	50 / M	146 / 86	148 / 86	148 / 88	142 / 86	148 / 88	144 / 82	152 / 90	146 / 84	196 / 90
128	Om Prakash	50 / M	106 / 70	108 / 70	110 / 70	106 / 72	110 / 72	104 / 68	126 / 76	108 / 74	132 / 74
129	Janak Dulari	50 / F	150 / 90	156 / 92	158 / 96	160 / 92	166 / 94	156 / 88	164 / 90	158 / 90	212 / 100
130	Chandra Grahan	50 / F	96 / 70	100 / 70	100 / 72	100 / 68	104 / 70	108 / 72	120 / 78	98 / 70	128 / 74